

Paramedic Critically Appraised Topic (CAT)

Title: Survival of prehospital cardiac arrest patients without return of spontaneous circulation on scene

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Second party appraiser:

Clinical scenario:

Paramedics are called to an unresponsive patient. Upon arrival on scene, they find the patient to be vital signs absent (VSA) and begin compressions, ventilation, and defibrillation. An ACP crew is not available. After four analyses without a return of spontaneous circulation (ROSC), the paramedics initiate transport to the nearest hospital. Does a patient who does not achieve a ROSC on-scene have better chances of survival if they are transported to a hospital?

PICO Question:

In prehospital cardiac arrest patients, does transport to a hospital prior to obtaining a ROSC result in better survival to discharge rates than obtaining a ROSC on-scene?

Search Strategy:

CINAHL:

- (Paramedic OR Emergency Medical Services OR Emergency Medical Technician OR Prehospital) AND (Cardiac Arrest OR Cardiopulmonary Resuscitation OR CPR) AND (Return of Spontaneous Circulation OR ROSC OR Resuscitation) AND (Transport OR Ambulance OR Ambulance Transport)
- Limiters: Articles published between January 1st, 2012 and December 31st, 2017
- See Appendix

Google Scholar:

- Cardiac Arrest AND Return of Spontaneous Circulation AND Transport*
- Limiters: Articles published since 2013
- 2,018 results

Backchaining:

- Reviewed the references of articles selected using previous search methods

Relevant Articles

Author and Date	Population: Sample Characteristics	Design	Measured Outcome	Results	Strengths and Weaknesses
Wampler et al (2012)	2,483 out-of-hospital resuscitation attempts	Retrospective Analysis. Study used data from San Antonio, TX,	Survival to hospital discharge	Out of the 2,483 out-of-hospital resuscitation attempts included in the study, 894 (36%) achieved a ROSC on-scene, and 868 (35%)	<u>Strengths:</u> Large sample size, extensive comparison between

	(1933 in San Antonio, 550 in Cincinnati). Demographics were similar between the two groups, except race.	and Cincinnati, OH cardiac arrest databases from 2008-2010.		were transported without a ROSC on-scene. Of these 868 patients, 11 survived to discharge. Overall, patients without an on-scene ROSC had a 0.69% chance of survival to discharge, in comparison to the average survival to discharge rate for out-of-hospital cardiac arrest during the same time period (6.6%).	survival rates in San Antonio vs. Cincinnati <u>Weaknesses:</u> Retrospective design of the study, no attempt to control for variables such as witnessed arrest, shockable rhythms, transport time, etc.
Drennan et al (2014)	5,871 out-of-hospital cardiac arrests of suspected cardiac origin without a prehospital ROSC and transported to hospital	Retrospective analysis. Study used data from Southern Ontario cardiac arrest databases from 2007-2013.	ROSC, Survival to hospital discharge	Of the 5,871 cases examined, 2,495 were eligible for a termination of resuscitation (TOR). Of these patients, 295 (11.8%) obtained a ROSC, and 15 (0.6%) survived to discharge. Of the 3374 cases that met continuation of resuscitation and transport criteria, 551 (16.3%) obtained a ROSC, and 122 (3.6%) survived to discharge.	<u>Strengths:</u> Collection of ROSC rates and survival to discharge rates, comparison of outcomes to current TOR guidelines and medical futility rates <u>Weaknesses:</u> Retrospective design, 32 hospitals were involved in the study, each potentially having different survival rates for cardiac arrest patients
Sasson et al (2010)	More than 142,000 patients over 204 studies. Exclusion criteria of studies included a majority of pediatric patients, a majority of non-cardiac etiologies, lack of survival to discharge data, and failure to mention the	Meta-Analysis. PubMed, EMBASE, Web of Science, CINAHL and EBM reviews were searched for relevant articles published between 1950 and 2008. Reference sections of relevant articles were searched, abstracts presented at conferences were reviewed, and experts were consulted for unpublished	Survival to discharge.	Of the studies examined, 12 researched the relationship between a prehospital ROSC and survival to discharge. 17,697 patients were collectively involved in the studies. 78% of the patients did not achieve a prehospital ROSC. Overall, these patients had a 0.1-1.8% chance of survival to discharge, in comparison to the 15.5-33.6% chance of survival to discharge in patients who achieved a prehospital ROSC. Of all the variables examined, a prehospital ROSC was the strongest predictor of a survival to discharge.	<u>Strengths:</u> Very large sample size, thorough systematic review of relevant articles, analysis of several variables that affect survival to discharge rates in prehospital cardiac arrest patients <u>Weaknesses:</u> No explanation for the wide variation in survival to discharge rates between studies, use of outdated studies.

	variables of interest	data. Variables of interest included arrest witnessed by bystanders, arrest witnessed by EMS, bystander CPR, presenting rhythm, and prehospital ROSC			
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Comments

Difficulties with selecting relevant articles for the study included the wide range of variables found in a prehospital cardiac arrest. Variables include the cause of cardiac arrest (medical, traumatic, hypoxic, toxicological, etc), witnessed cardiac arrest, shocks administered prior to EMS arrival, level of EMS attending, varying protocols regarding cardiac arrest, and distance to hospital. Some studies attempted to control for some or all of these variables, while other studies did not, making it difficult to compare results between studies. One of the studies in particular compared prehospital cardiac arrest survival rates with the medical futility rule (any intervention with a chance of survival of under 1% is considered medically futile). They also used this rule to determine if the current TOR criteria were accurate predictors of chance of survival. This was an interesting method to measure chance of survival, as it applied a rule commonly used in hospital medicine to the prehospital environment.

Consider

The first study discussed in this CAT found that patients without a prehospital ROSC were significantly less likely to survive to discharge than patients who did achieve a prehospital ROSC. In the study that compared survival to discharge rates to medical futility, patients that fit TOR criteria had survival to discharge rates below the level of futility, while patients that did not fit TOR criteria had survival rates that were above the level of futility. These two studies together suggest that while the overall chance of survival to discharge in patients without a prehospital ROSC is lower than those who achieved a prehospital ROSC, patients who do not fit TOR criteria should still be transported to the hospital. The study concludes that the current TOR criteria are reliable predictors of survival. The meta-analysis had a widely varying rate of survival to discharge (0.1-1.8%), which straddles the line of medical futility, and is too wide to make definitive conclusions based on the results.

Clinical Bottom Line

From the results analysed in this mini-CAT, it is advisable that current transport guidelines be maintained. Paramedics attending to prehospital cardiac arrests which fit TOR criteria should consult a base hospital physician to discuss termination of resuscitation efforts, while all other patients should be transported to hospital. Further studies should assess whether it is beneficial to continue resuscitation efforts on scene for longer than the currently recommended four shocks as opposed to initiating transport without a ROSC, and exposing the patient to sub-optimal CPR during packaging and transport.

References:

- Drennan, I.R., Lin, S., Sidalak, D.E., & Morrison, L.J. (2014). Survival rates in out-of-hospital cardiac arrest patients transported without prehospital return of spontaneous circulation: an observational cohort study. *Resuscitation*, 85; 1488-1493.
- Sasson, C., Rogers, M.A.M., Dahl, J., & Kellermann, A.L. (2010). Predictors of survival from out-of-hospital cardiac arrest. *Circulation Cardiovascular Quality Outcomes*, 3; 63-81.
- Wampler, D.A., Collett, L., Manifold, C.A., Velasquez, C., & McMullan, J.T. (2012). Cardiac arrest survival is rare without prehospital return of spontaneous circulation. *Prehospital Emergency Care*, 16; 451-455.

APPENDIX

CINAHL Search results:

#	Query	Limiters/Expanders	Results
S19	S14 AND S15 AND S16 AND S17	Limiters - Published Date: 20120101-20171231 Search modes - Boolean/Phrase	56
S18	S14 AND S15 AND S16 AND S17	Search modes - Boolean/Phrase	225
S17	S11 OR S12 OR S13	Search modes - Boolean/Phrase	14,177
S16	S8 OR S9 OR S10	Search modes - Boolean/Phrase	17,255
S15	S5 OR S6 OR S7	Search modes - Boolean/Phrase	11,559
S14	S1 OR S2 OR S3 OR S4	Search modes - Boolean/Phrase	29,193
S13	ambulance transport	Search modes - Boolean/Phrase	241
S12	transport	Search modes - Boolean/Phrase	10,502
S11	ambulance	Search modes - Boolean/Phrase	4,506
S10	resuscitation	Search modes - Boolean/Phrase	17,176
S9	rosc	Search modes - Boolean/Phrase	184
S8	return of spontaneous circulation	Search modes - Boolean/Phrase	400
S7	cpr	Search modes - Boolean/Phrase	2,825
S6	cardiopulmonary resuscitation	Search modes - Boolean/Phrase	7,354
S5	cardiac arrest	Search modes - Boolean/Phrase	5,072
S4	prehospital	Search modes - Boolean/Phrase	11,592
S3	emergency medical technician	Search modes - Boolean/Phrase	8,071
S2	emergency medical services	Search modes - Boolean/Phrase	19,471
S1	paramedic	Search modes - Boolean/Phrase	2,214